

used to investigate overall dose-response effects. The χ^2 test compared individual low values for overnight urinary cortisol with each formulation.

There were no significant differences between placebo values before HFA-FP and CFC-FP and there was no sequence effect. There was significant overall dose-related adrenal suppression on overnight and early morning urinary cortisol/creatinine excretion with HFA-FP ($p < 0.01$) and CFC-FP ($p < 0.0001$), as shown in the table. At the medium dose level of 500 μg twice a day, there was significantly ($p < 0.05$) greater suppression with CFC-FP than HFA-FP for overnight urinary cortisol/creatinine (geometric mean fold ratio and 95% CI): 1.9-fold (1.2–3.2), and early morning urinary cortisol/creatinine: 1.8-fold (1.1–2.8). For all three doses taken together (figure), there were significantly ($p < 0.001$) more individual low values for overnight urinary cortisol excretion ($< 10 \text{ nmol}/10 \text{ h}$) with CFC-FP (31%) than HFA-FP (15%), compared with placebo (0).

Our results have shown that the lung bioavailability of CFC-FP was about two-fold greater than HFA-FP for the same labelled dose in terms of sensitive markers of adrenal suppression, and consequently a two-fold increase in lung delivery. For effects on early morning urinary cortisol/creatinine excretion, a significant difference between the formulations was found at the medium but not the high dose level. This can be explained by a greater degree of intra-individual variability in the response ratio at 1000 μg twice a day: 1.9-fold (0.9–4.0), compared with the ratio of 500 μg twice a day: 1.8-fold (1.1–2.8). Furthermore, when inspecting individual values for all three doses taken together, there was also a two-fold greater proportion of individual low values for overnight urinary cortisol excretion when comparing the two formulations.

Although our data was from healthy individuals, the relative ratio for systemic bioactivity would be the same as in asthmatic patients, assuming that the consequences of a reduction in airway calibre would affect both formulations to a similar degree. The magnitude of the absolute degree of adrenal suppression for each formulation would be lower in asthmatic than in healthy people, due to reduced lung bioavailability with the former. We were unable to directly extrapolate our data on relative lung bioavailability in healthy individuals to the anti-inflammatory activity in asthmatic patients, although intuitively a lower degree of therapeutic efficacy would be predicted for a given labelled dose of the HFA formulation. We ensured strict control of inhaler technique throughout the study, to try to eliminate differences between individuals in lung delivery due to poor coordination.

There are not much published data on the pharmaceutical characteristics of the HFA-FP formulation. In an abstracted in-vitro study from Glaxo Wellcome with an Andersen cascade impactor, it was found that 125 μg and 250 μg strength formulations of HFA-FP and CFC-FP exhibited similar performance in terms of fine-particle dose delivery.² This emphasises the need to do in-vivo studies as the only proper way of evaluating the unique interaction between the patient and the inhaler device, as well as assessing pharmacodynamic responses for antiasthmatic efficacy and systemic adverse effects. In an abstracted crossover study of 112 severe asthmatics using 2 mg/day of CFC and HFA formulations of FP given for 6 weeks, equivalent antiasthmatic efficacy on peak flows was found whereas serum cortisol levels were significantly lower with CFC-FP.³ However, the 2 mg dose of FP was almost certainly on the flat part of the dose-response curve for peak flow and so it was not possible to make any valid conclusions about relative antiasthmatic efficacy without a proper dose-response evaluation.

In conclusion, direct switching between CFC-FP and

HFA-FP on a μg equivalent basis (puff for puff) for the labelled dose may be inadvisable, because the lung dose from the new HFA formulation was about two-fold lower than the old CFC formulation. Further studies are needed to properly characterise the dose-response relationships for airway and systemic effects of these formulations in asthmatic patients, before rational dosing recommendations can be made for switching patients from the CFC to the HFA formulation.

This study received no support from the pharmaceutical industry. The spouse of Brian Lipworth has shares in Glaxo Wellcome, while the Allergy and Asthma Research Group has received educational and equipment grant aid support from Glaxo Wellcome.

- 1 Wilson AM, Lipworth BJ. 24 hour and fractionated profiles of adrenocortical activity in asthmatic patients receiving inhaled and intranasal corticosteroids. *Thorax* 1999; **54**: 20–26.
- 2 Cripps AL, Munro AJ, Boles MG, Roche TC, Sawyer SE, Stevens JC. Pharmaceutical evaluation of a new HFA-based metered dose inhaler for fluticasone propionate. *J Aerosol Med* 1997; **10**: PD 6–5 (abstr).
- 3 Ayres J, Millar A, Williams E. A twelve week multicentre study comparing the efficacy and tolerability of fluticasone propionate 2 mg daily propelled by chlorofluorocarbons 11 and 12 or an alternative propellant, GR106642X in adults with severe asthma. *Eur Respir J* 1995; **8** (suppl 19): 157s (abstr).

Asthma and Allergy Research Group, Department of Clinical Pharmacology & Therapeutics, Ninewells Hospital and Medical School, University of Dundee, Dundee DD1 9SY, Scotland, UK
(A M Wilson MBChB, E J Sims BSc, L C Orr MSc, Prof B J Lipworth MD)

Correspondence to: Prof B J Lipworth
(e-mail: b.j.lipworth@dundee.uk)

Are UK doctors particularly stressed?

I C McManus, B C Winder, D Gordon

Doctors are thought to have higher levels of stress than the general population. However, in a survey of a nationally representative sample of UK doctors, we found that stress levels were equivalent to those in the general population; previous findings may have been biased by inappropriate use of the general health questionnaire.

The British Medical Association's report entitled Stress and the Medical Profession¹ began a concern that UK doctors have high stress levels, despite, as Caplan² put it, "contain[ing] no references or information about measured levels of stress or psychological symptoms in senior hospital doctors" (nor indeed any other group except preregistration house-officers [interns]). A series of studies with the general health questionnaire³ (GHQ; table) have suggested that "the prevalence of minor psychiatric disorder among NHS trust staff is high compared with that for employed people in general".⁴ A possible limitation of these studies is that doctors were sent questionnaires explicitly about stress and work problems, so the context may have created a demand characteristic. By contrast, when used as a validated clinical screening instrument for patients, the GHQ does not include the word stress in its rubric, but mentions only "medical complaints" and "health in general". We describe a large, representative, national survey of UK doctors, which mainly concerned issues other than stress, and in which the GHQ was only a small component on the last page of the questionnaire.

The GHQ-12 with the rubric "Your health generally, in the past few weeks" was included as part of a survey of attitudes of UK doctors towards the General Medical Council's performance procedures. Scoring was on a 0-0-1-1 basis (ie, a score of 1 or 2 was given a value of 0 in logistic regression, and a score of 3 or 4 was given a value of 1) for assessment of high

Study	Population studied	Response rate	Survey	Threshold	Prevalence of stress	Prevalence in general population
Ref 2	81 consultants; 322 general practitioners.	80%	GHQ-28	5/6	47%	27%†
Blenkin H, et al. <i>BMJ</i> 1995; 310 : 534.	500 hospital consultants.	75%	GHQ-28	5/6	21%	..
Ramirez JA, et al. <i>Lancet</i> 1996; 347 : 724-28.	1133 hospital consultants.	78%	GHQ-12	3/4	27%	..
Ref 5	1379 doctors employed by 19 NHS trusts.	61-65%	GHQ-12	3/4	28%	18% (BHPS)
Kapur N, et al. <i>BMJ</i> 1998; 317 : S11-12.	445 doctors employed by 19 NHS trusts.	60%	GHQ-12	3/4	25%	..
Appleton K, et al. <i>Br J Gen Pract</i> 1998;	406 general practice principals.	70%	GHQ-12	2/3	52%	20-30% †
Guthrie E, et al. <i>Psychiatr Bull</i> 1999; 23 : 207-12.	138 psychiatrists.*	77%	GHQ-12	3/4	31%	..

GHQ=General health questionnaires; BHPS=British household panel survey. *Senior house-officers, registrars, senior registrars, consultants †Estimated from published studies.

Prevalence of stress as measured by GHQ in doctors

stress levels (3/4 threshold), and on a 0-1-2-3 basis for other analyses. The questionnaire was received by 1557 doctors randomly drawn from the 104 433 doctors in the Medical Directory, in a balanced factorial design with equal proportions of men and women, of hospital doctors and general practitioners, and of those who qualified in 5-year bands between 1955-59 and 1990-94; one in five had qualified outside the UK. Half the questionnaires were distributed in November, 1997, and the rest in November, 1998. The overall response rate was 81.0%. Logistic regression suggested that respondents were more likely to work in hospitals than in general practice (83.9% vs 79.0%, $p=0.008$), were more likely to have qualified in the UK than in other countries (83.2 vs 74.3%, $p=0.0002$), and were more likely to have received the 1998 than the 1997 survey (84.6 vs 78.3%, $p=0.0008$); there were no differences by sex or year of qualification (linear or quadratic). The health and lifestyle survey⁵ (HALS) and the British household panel survey⁴ (BHPS) were used for comparison; each was a nationally representative survey in which the GHQ contributed only a small part of the data. The BHPS used GHQ-12, and the HALS used GHQ-30 from which the GHQ-12 items were disembedded by use of raw data available for secondary reanalysis. Scoring was on a 0-0-1-1 basis with a 3/4 threshold.

In our study, 1013 doctors completed the GHQ, of whom 16.9% (95% CI 14.6-19.2) were above the normal threshold. By ANOVA, there were no differences in sex, place of qualification, type of practice (hospital vs general practice), or year of study among doctors. There was, however, a significant linear and quadratic effect of year of qualification ($p=0.026$, and $p=0.001$, respectively). Mean scores were highest in those in mid-career (figure). No interactions were significant.

The prevalence of stress in the general population, as

measured by HALS, was 14.1% (13.4-14.8, $n=9003$), and by the BHPS was 17.8% (16.7-18.9, $n=5001$). The distributions of GHQ-12 scores in the general population (by HALS) and in doctors were very similar (figure). However, the comparison with doctors can be only approximate, since a range of possible confounding factors cannot be taken into account.

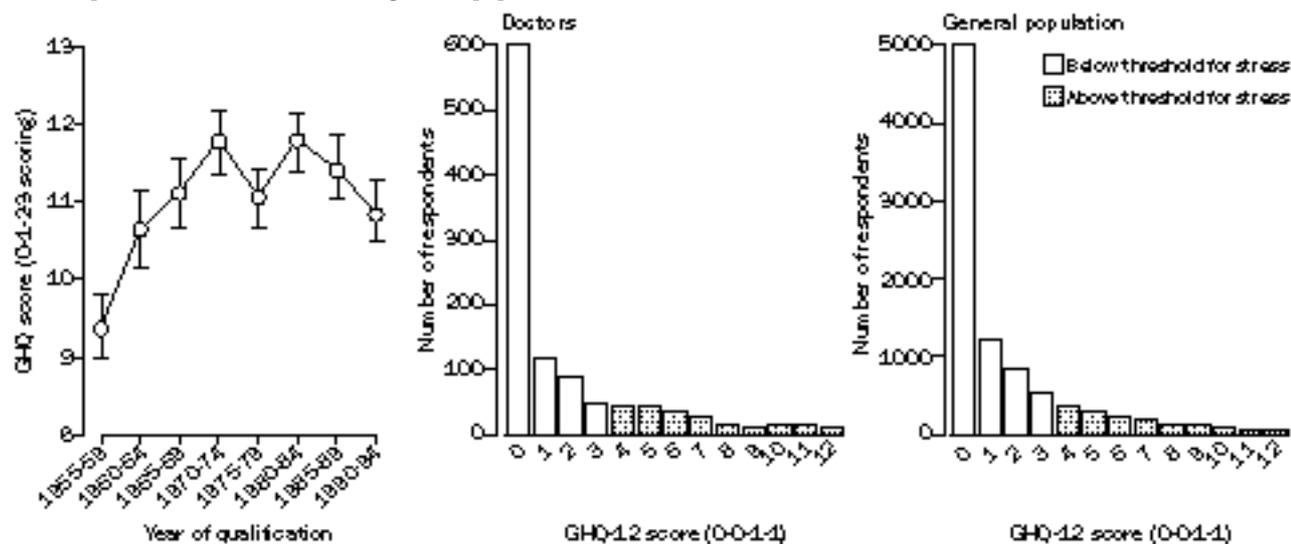
Our data suggest that although some doctors are undoubtedly under stress, and show evidence of this on the GHQ, there is no evidence that the prevalence is substantially different from that in the population in general. That previous studies have suggested otherwise may be an artefact of excessive mention of stress in the questionnaires themselves.

This study was funded by the UK General Medical Council as a part of the assessment of its performance procedures.

- 1 British Medical Association. Stress and the medical profession. London: British Medical Association, 1992.
- 2 Caplan RP. Stress, anxiety, and depression in hospital consultants, general practitioners, and senior health service managers. *BMJ* 1994; **309**: 1261-63.
- 3 Goldberg DP, Gater R, Sartorius N, et al. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychol Med* 1997; **27**: 191-97.
- 4 Wall TD, Bolden RI, Borrill CS, et al. Minor psychiatric disorder in NHS Trust staff: occupational and gender differences. *Br J Psychiatry* 1997; **171**: 519-23.
- 5 Cox BD, Blaxter M, Buckle ALJ, et al. The Health and Lifestyle Survey: preliminary report of a nationwide survey of the physical and mental health, attitudes and lifestyle of a random sample of 9003 British adults. London: Health Promotion Research Trust, 1987.

Research Centre for Medical Education, Centre for Health Informatics and Multi-professional Education (CHIME), Royal Free and University College Medical School, London N19 3UA, UK (Prof I C McManus FRCP, B C Winder MSc, D Gordon MA)

Correspondence to: Prof I C McManus (e-mail: i.mcmanus@ucl.ac.uk)



Prevalence of stress among doctors and the general population

Line graph shows GHQ score of doctors by year of qualification; points=mean, error bars=SE. Bar charts show distribution of GHQ scores in doctors and the general population; general population data were from the health and lifestyle survey.